HISTORY AND DEVELOPMENT
of the
BUZZARD POINT STATION
POTOMAC ELECTRIC POWER COMPANY

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POTOMAC ELECTRIC POWER COMPANY

SUMMARY

Since 1896 Washington has been served by the Potomac Electric Power Company, which bought out all of its competitors and built the present plant at Benning in 1906. This initial installation of 25,000kw. was added to, from time to time, to keep up with the growing demand for power until it was developed to the greatest extent, to which it could be operated economically in 1931, when it had a total capacity of 208,000 kw. In March 1933, the 230,000 volt line connecting Washington with the Safe Harbor hydro-plant on the Susquehanna was put into service, insuring Washington a reliable supply of power under all circumstances. To keep up with the demand, plans were drawn up for a new plant, which it was finally decided to build at Buzzard Point in Southwest Washington. This plant was opened in November 1933 as a base load station with a capacity of 35,000 kw. Because of its modern design and the fact that it operates as a base load station, Buzzard Point operates at a much higher efficiency than any other unit of the Potomac Electric Power Company.

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BACKGROUND

From the initial installation at Benning in 1906 of 5-5,000 kw.,vertical type turbine-generators there have been frequent additions and improvements of equipment with subsequent removal of obsolete units, until the addition of a new 30,000 kw. unit in 1931 completed the economic development of this station. The total capacity of Benning was now 208,000 kw. which, since the removal of the old plant at 14th and B Streets was the total source of power for the District of Columbia and vicinity.

With an eye toward improving the reliability as well as the quantity of service, a modern 230,000 volt transmission line was built to connect with the line from Baltimore to the Safe Harbor hyrdo-plant on the Susquehanna river in March 1933. It was realized that the Benning plant was subject to river conditions, as happened on March 2, 1914 when it was forced to shut down bacause an extra low tide left it without adequate condensing water; and again, on August 23, 1933 it was drowned out by flood, and the new inter-connection with Safe Harbor showed its worth. A maximum load of 60,000 kw. can be taken from Safe Harbor or sent to Baltimore in case of low water in the Susquehanna.

As early as January 1931 plans were considered for building a new steam plant to operate in conjunction with

Benning. The site for the new plant was considered very carefully. The number of possible sites finally came down to three: Giesboro Point on the south side of the Anacostia river, site of the old wartime steel plant; some point on the Virginia side of the Potomac above Alexandria; and Buzzard Point on the north side of the Anacostia river, near the Army War College. Objections to the first two were that cables would have to be laid across the river to the main load centers, and that they are farther from these load centers.

Other advantages of Buzzard Point are: an ample supply of condensing water is available; coal or other fuel can be brought by rail or water; and the area is zoned for industrial purposes. The fact that Buzzard Point was in line for future development as a park called for careful consideration of architectural design.

The design called for an initial installation of one 35,000 kw. unit and two boiler units, with space for another similar unit, the two to be operated from separate boilers.

Construction was started late in 1932 and the station put in operation as a base load station in conjunction with Benning and Safe Harbor on November 16, 1933. The total cost of the plant approximated $5,000,000.

The ultimate development of the site will include four more 50,000 kw. generators for a total capacity of 270,000 kw.

FEATURES OF THE STATION

The arrangement of the boiler operating room and turbine room is such that the operators of one are easily accessible to the other. The boiler units are Babcock and Wilcox single pass, long crossdrum 72 in. by 33 ft.6 in. type designed to burn a variety of coals, fuel oil or natural gas. West Virginia coal is used at present. Boiler pressure of 650 lb. and temperature at the turbine throttle of 835 deg.F. allow maximum efficiency with a great degree of reliability. A simple regenerative cycle with three stage bleeding for feed water heating is used.

Because of the probability of rapid fluctuation in load when running a steam station in parallel with a hydro-station, the boilers were designed to give maximum "pick up" ability from low load conditions.

Due to its proximity to the many public buildings of the Mall, it was extremely important to eliminate smoke conditions. For this purpose the stack is provided with a Cottrell electro-static precipitator in addition to complete automatic combustion control.

The boilers are each provided with two Riley mills and six burners. The present capacity of the boilers is 375,-000 lb. of steam per hour, representing nearly 12,000 boiler horse power. The boilers are completely water cooled and equipped with a slag screen just above the burners, composed of staggered tubes covered with refractory material, which causes the slag to run down and drip off into the pit. The burners are fired downward so that the flame impinges on the slag at the

bottom causing the larger particles to be thrown off. The superheater is arranged in two sections with a desuperheater between, to control the temperature of the steam as it leaves the boiler.

The turbine is a single cylinder, eighteen stage General Electric unit rated at 35,000 kw. at 1,800 r.p.m. It is set crosswise of the turbine room over a 30,000 sq.ft. Ingersoll-Rand condenser of the single-pass, two-compartment type. Bleeding for feed water heating is done from the 7th, 11th and 14th stages. The heaters are Foster-Wheeler direct contact type requiring a pump for each heater.

The generating unit is a General Electric unit rated at 38,888 kva. at 90% power factor, 60 cycles, 13,800 volts. The exciter unit consists of direct connected main and pilot exciters. A spare motor driven exciter of 200 kw. capacity is installed for use in emergency. The generator is air cooled using river water as the cooling medium.

The lubrication system is very interesting. With the use of high temperature steam the danger of fire from leaking oil became increasingly great. There have been several disastrous fires due to this cause. With this in mind the designers of Buzzard Point incorporated a system whereby much danger is eliminated. All high pressure oil lines are enclosed inside low pressure return lines, thereby greatly reducing the danger of leakage. All the oil pumping equipment is located in a small fireproof room under the turbine itself. It is protected by a Lux carbon dioxide automatic extinguishing system and is com-

pletely enclosed by itself. There is a separate room for oil storage, cleaning and filtering, which is protected by a steam-smothering system.

The station auxiliaries are all driven by electric motors with the exception of one feed water pump, which is driven by a 700 horse power, single stage non-condensing turbine for use in emergency. This turbine is capable of gaining full speed from cold start in 30 seconds. The three feed pumps are seven stage centrifugal pumps each capable of handling hot water at 357 deg.F. at the rate of 800 gallons per minute.

Since ultimately each boiler will operate a single turbine all the auxiliaries are grouped separately. A 4,000 kva. 13,800/2,300 volt, three phase transformer supplies the auxiliaries of each main unit.

All except the smaller motors and the coal handling motors are 2,300 volt units, the others being 440 volts. The forced draft fans are run by constant speed squirrel cage motors, speed control of the fans being done by hydraulic couplings. These couplings give wide range control with high efficiency. The speed is controlled by changing the oil level in the coupling.

The electrical equipment is concentrated at one end of the building. The top floor houses the switch-board room , in which the main switch-board, automatic voltage control unit and station battery charging set are located. The switch-board is of the bench type with vertical back panel. The various indicating instruments and control switches are located here. In back of the main switch-board on a separate panel are the various relays and recording instruments. Located in a glass enclosed room off

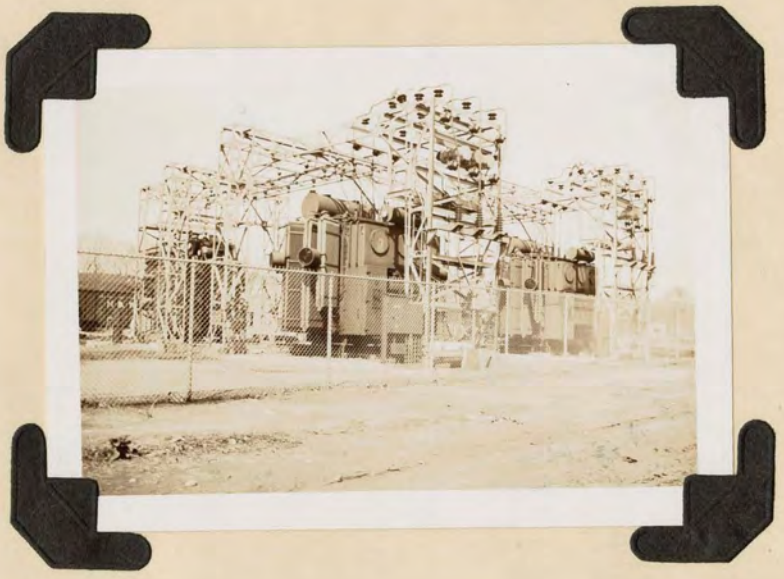
the main switch-board room is the automatic voltage regulator equipment, which is of the FA-4 type. The battery charging equipment is at one side of the control room , separated by an iron cage.

The two main 13,800 volt busses occupy the fourth floor of the electrical bay. They are enclosed in reinforced concrete structures, as are the oil circuit breakers and disconnect switches located on the third and fifth floors. These oil circuit breakers are General Electric units rated at 1,500,000kva rupturing capacity and have an arc-rupturing time of 8 cycles compared to a 60 cycle timing wave. The disconnects are all of the remote mutual gang operated except the H tie disconnects which are motor gang operated and controlled from the main switch-board. On the second floor are the feeder reactors, rated at 5%. On the first floor are the out-going feeder disconnects and potheads, and the cable test bus. The station service control switch-board is located between the turbine room and the boiler-operating room. From it are controlled the auxilliaries of the plant.

Buzzard Point is tied in with Benning by a 33kv tie-line and with Takoma by another 33 kv line through SUB-13, located at 13th and Harvard streets. Six 13,800 volt feeders connect with SUB-16 in the downtown area, direct from the station busses. Another 13,800 volt serves the Bureau of Engraving and Printing. The 13,800 volt feeders are of the three conductor, 350,000 circular mil type H cables. The transformer system for the 33 kv tie-lines consists of three 20,000 kva

transformers, two of which are phase changers.

Because of the danger of the load being dropped in case of a 3-phase fault in the busses of one of the substations these busses were split at SUB-13, SUB-16, and SUB-5. Buzzard Point feeds both parts of the busses at SUB-13 and SUB-16 with separate cables therefore insuring continuance of service in case of a fault. SUBS-13 and 5 connect with Takoma and thence to Safe Harbor, therefore it is important that they be free from disturbance. SUB-16 is important because it serves the main business district of the city as well as the Government buildings of the Mall.



20,000 kva, 13,800/33,000volt transformers
at Buzzard Point Plant

The archetecture of the building is simple and promises not to mar the beauty of any future development at Buzzard

Point. The 90 ft. building looks somewhat modernistic with its high windows, square corners and octagonal stack, which is 180 ft. high. The construction is of steel, brick and concrete block and is finished in a dull white shade. The station was designed and built by Stone and Webster Engineering Corporation in co-operation with Potomac Electric Power Company officials and engineers.

OPERATION OF THE PLANT

Since Buzzard Point Station has been in operation it has shown very high efficiency due both to its careful design and to the fact that it is operated as a base load station. The great increase of efficiency over the older units at Benning is shown by the accompanying chart. The best efficiency of the old vertical 5,000 kw.units at Benning was about 2.05 lbs. of coal per kwh. while Buzzard averaged for the year 1934,.888 lbs. per kwh. and in 1935,.881 lbs. per kwh.

Following are a few statistics for these years:

	1934	1935
Gross generation	202,267,000	222,886,000
Station service	11,266,700	11,740,900
Net generation	191,000,300	211,145,100
Hours of operation	7,746	7,513
Coal burned (lbs.)	169,782,500	186,628,100
BTU/lbs. coal	14,305	14,193
Lbs. coal/kwh.	.888	.881
Overall boiler efficiency	84.28	83.7

It is interesting to note how the efficiency goes up as the steam pressure increases. The older units were operated at 200 lbs. and then improvements of design made it possible to operate safely at 400 lbs. which led to greater economy. At present the highest pressure, with its accompanying high temperature, that can be used safely with the metal available is around 650 lbs., which is that used at Buzzard Point. Other contributing factors to the high efficiency of the station are use of pulverized coal fuel with its ease of combustion control, and the use of an air preheater and three stage bleeding for feed water heating.

Buzzard Point Plant, as a whole strikes me as being a well designed plant from the standpoint of ease of operation and efficiency. Very few men are needed to tend the plant in normal operation. Probably the near future will see the addition of another 35,000 kw generator which can be operated almost as easily as the present one.

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Potomac Electric Power Company Engineers:

Mr. W. J. Lank --Assistant chief engineer

Mr. R. B. Kellogg --Plant engineer, Buzzard Point

Mr. C. E. Miller--Test engineer, " "

Mr. H. B. Pollack--Switch-board operator, " "

Mr. J. W. Thomas --Watch engineer, " "

Mr. C. B. Tyson Jr. -- Plant clerk.

COMPARISON OF COAL RATES

POTOMAC ELECTRIC POWER CO.

ELECTRICAL ENGINEER'S OFFICE

SUBJECT

POUNDS OF COAL PER KWH

30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9

200 LB. 550° TOTAL TEMP. VERTICAL UNIT
BENNING STATION

200 LB. 550° TOTAL TEMP. HORIZONTAL UNIT
BENNING STATION

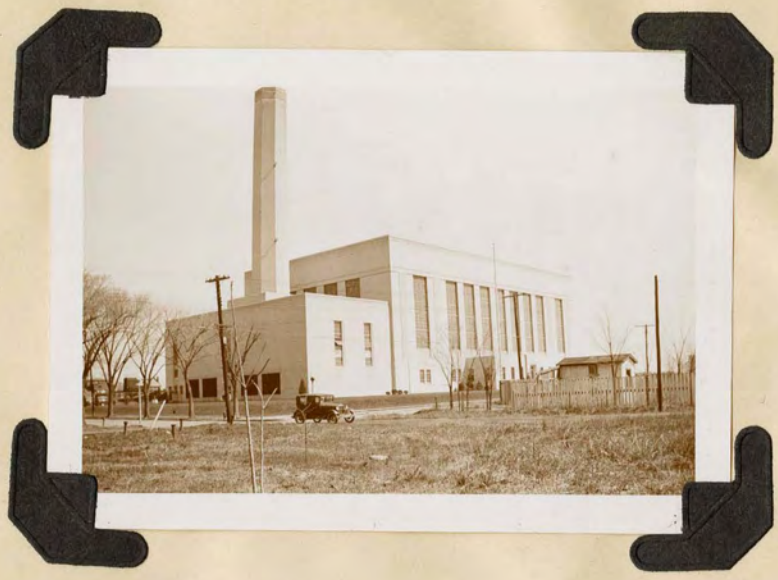
400 LB. 700° TOTAL TEMP. UNIT - BENNING STATION
WITH STAGE BLEEDING - STOKER FIRED BOILERS

600 LB. 825° TOTAL TEMP. UNIT - BUZZARD STATION
STAGE BLEEDING - PULVERIZED FUEL BOILERS

THOUSANDS K.W. LOAD

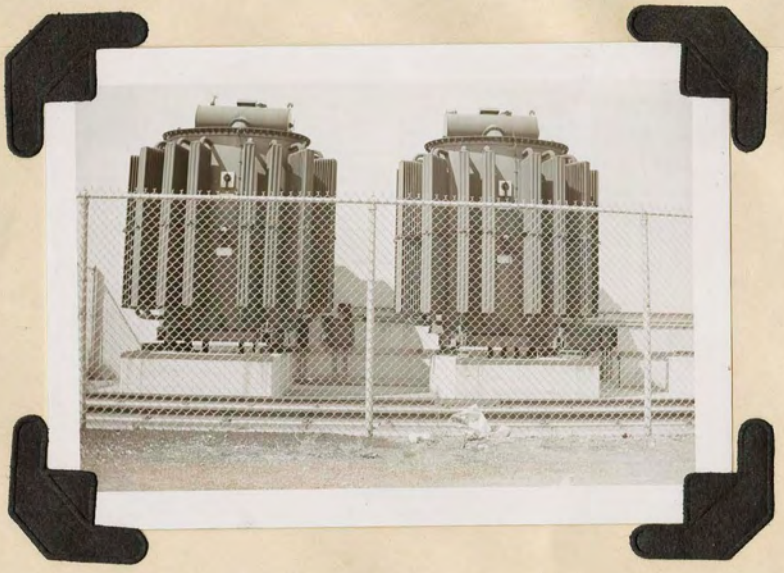
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36

PRINTED ON "IMPERIAL" TRACING CLOTH



General view of the plant from the south-west.

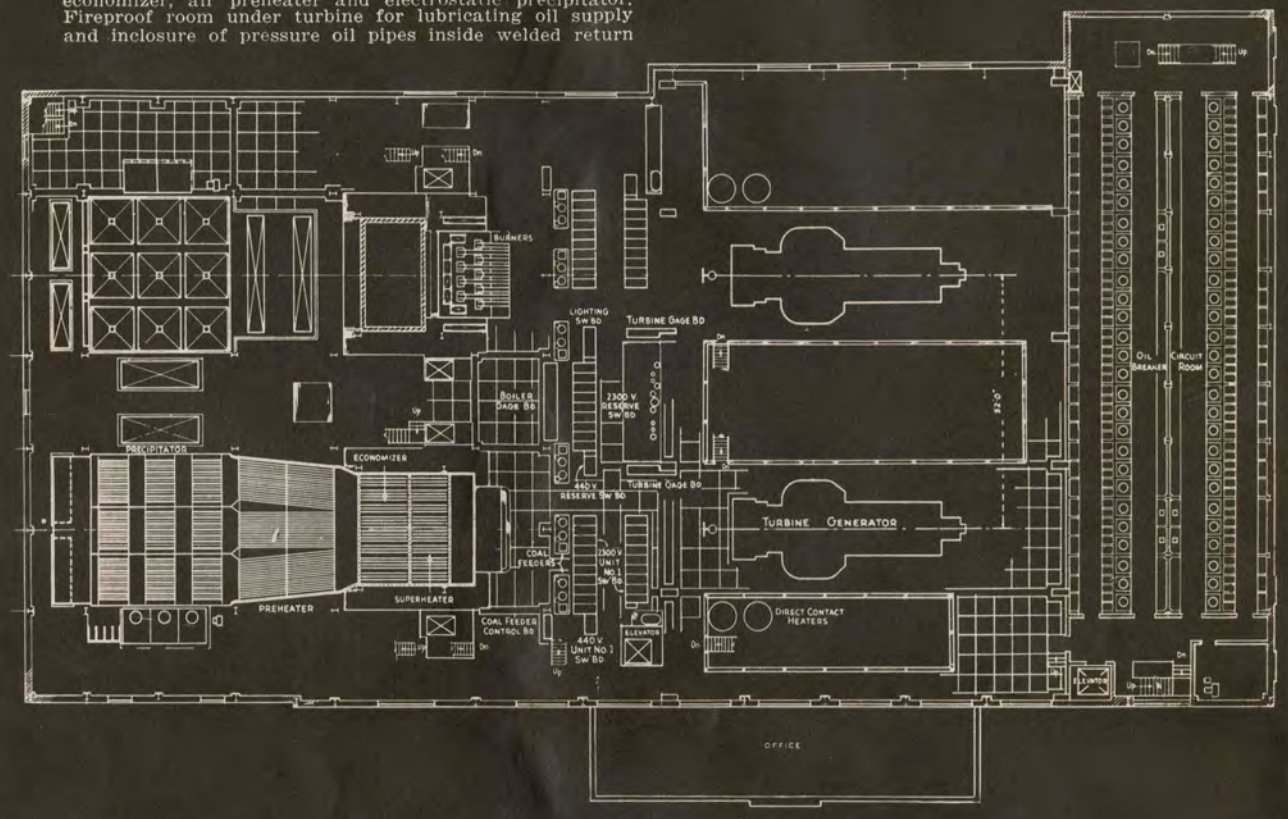
A view of the front of the building in which the office and lobby are located. The plant fronts on the Anacostia River.

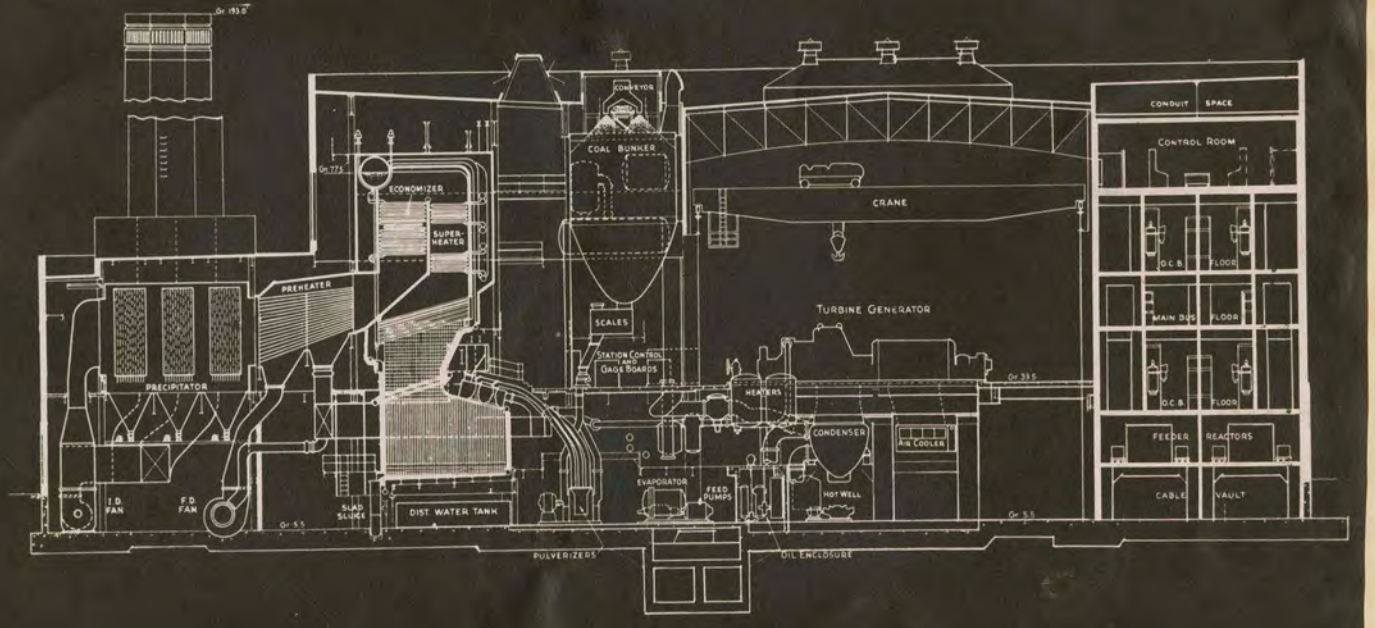


The two 13,800/2300 volt station service transformers.

Figs. 1 and 2—Plan and cross-section of new station

Absence of wall between boiler and turbine rooms makes operators readily accessible to each other. Note use of high single-pass boiler with divided superheater, integral economizer, air preheater and electrostatic precipitator. Fireproof room under turbine for lubricating oil supply and inclosure of pressure oil pipes inside welded return drain lines avoid fire hazard. Unit-type pulverizers, vertical firing and slag-tap furnaces constitute other features.





Plan and cross-section of Buzzard Point Station.